

## LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Dec. 17-21, 2012.



**GUARDED BETTER THAN GOLD**



### **Bruce Goodwin**

More than 58,000 nuclear weapons have been dismantled since the atomic age began. That's a lot of fissile material to account for, and protecting it takes a lot of work.

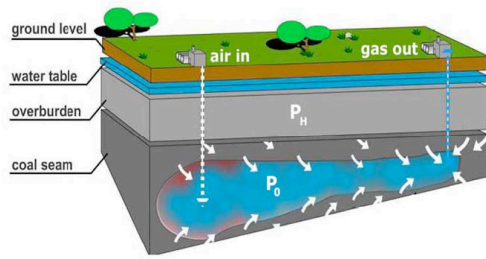
"They control plutonium down to the level of a gram; they control uranium down to the level of a gram," said Lawrence Livermore's Bruce Goodwin, principal associate director for the Weapons and Complex Integration program. "It makes Fort Knox look like Joe's Diner. We guard this stuff better than we guard gold."

LLNL also is helping perfect the integrity of the existing nuclear weapons in its arsenal. The Lab developed the Mechanical Safety and Arming Device (MSAD), which uses a complex series of digits or a mechanical code that if not entered in the right series, lock and disable the weapon.

To see more, go to [The History Channel](#).



**GOING UNDERGROUND TO LOWER COSTS**



Underground coal gasification (UCG) is seen as a relatively low-impact way of tapping the huge U.S. coal resource, while potentially managing emissions. But it hasn't really taken off thanks to shale gas, which has a far cheaper price tag.

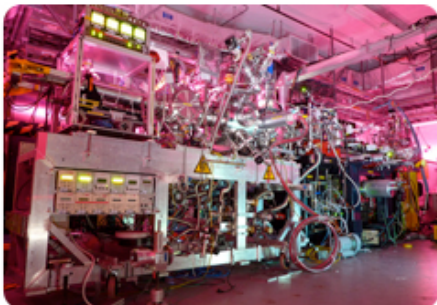
UCG heats underground coal seams to the point of combustion. It involves drilling two wells -- at some distance from each other -- into the coal seam. The first well supplies oxidants (a mixture of water and air or water and oxygen), which are injected into the location where the process is actually occurring. The second well permits the syngas produced to escape under pressure to the surface.

While U.S. shale gas at \$3.75 is currently far cheaper than the \$6 per million British thermal units cost of fuel for a typical UCG project (per estimates from Julio Freedman, chief energy technologist at Lawrence Livermore National Laboratory), the UCG costs are dropping.

To read more, go to [Forbes](#).



**TAKING AIM AT PLASMAS**



## **An instrument setup for an astrophysics experiment at the SLAC National Accelerator Laboratory's Linac Coherent Light Source (LCLS).**

An international collaboration including researchers from Lawrence Livermore has refined a key process in understanding extreme plasmas such as those found in the sun, stars, at the rims of black holes and galaxy clusters.

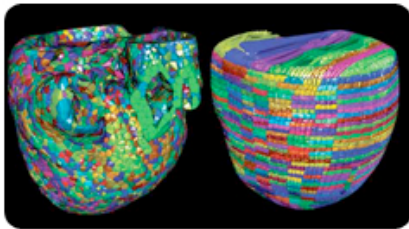
In short, the team identified a new solution to an astrophysical phenomenon through a series of laser experiments. The team used powerful X-rays from the Linac Coherent Light Source (LCLS) at the SLAC National Accelerator Laboratory to study and measure, in atomic detail, a key process at work in extreme plasmas such as those found in stars, the rims of black holes and other massive cosmic phenomena.

The results explain why observations from orbiting X-ray telescopes do not match theoretical predictions, and pave the way for future X-ray astrophysics research using free-electron lasers such as LCLS. With its bright, ultrafast X-ray laser pulses, LCLS allows scientists to create and measure atomic processes in extreme plasmas in a fully controlled way for the first time

To read more, go to [Science Daily](#).



**GETTING TO THE HEART OF THE MATTER**



**The Cardioid code divides the heart into a large number of manageable pieces, or subdomains.**

Lawrence Livermore scientists have harvested the energy of one of the world's largest supercomputers (Sequoia) to simulate the human heart down to the cellular level.

"The electric signal that transmits around the heart, we can now model at the near cellular resolution in real time," said Fred Streitz, director of Lawrence Livermore's High Performance Computing (HPC) innovation center.

The simulations could have considerable impact on the health care industry and further advance medical science.

To see more, go to [NY1](#).



**PARTNERING FOR AN ENERGY FUTURE**



**LLNL Director Parney Albright and North Dakota State University President Dean Bresciani sign a partnership agreement as U.S. Sen. John Hoeven looks on.**

Lawrence Livermore National Laboratory has partnered with North Dakota State University (NDSU) to collaborate on research and development projects involving computational-based modeling and simulation for energy and energy-related applications.

NDSU President Dean Bresciani and LLNL Director Parney Albright finalized the agreement at a signing ceremony at NDSU on Dec. 14.

Collaboration between the national lab and NDSU's advanced computing capabilities through the NDSU Center for Computationally Assisted Science and Technology (CCAST) is expected to lead to opportunities for NDSU students and faculty participating in the R&D partnership.

To read more, go to [Newswise](#).



## ***Livermore Lab Report* takes a break**

The *Livermore Lab Report* will take a break for the holidays. It will return the week of Jan. 7.

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LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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